Updates on GLOBE Clouds

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Deputy Coordinator, GLOBE Observer

Citizen Science Cloud Observations

GLOBE Observer

- In January, GLOBE and S'COOL programs formally started to merge.
- GLOBE Cloud Observers started receiving cloud satellite matches, when their observations correspond to an overpass

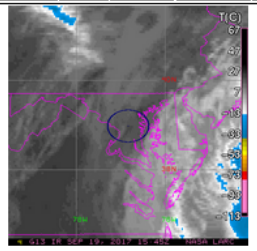
GLOBE Cloud Observation and NASA's Satellite Match

Ground Observation: 471404				GEO Satellite					Terra Satellite				
Latitude : 38.99 Longitude : -76.84				Latitude : 0.00 Longitude : -75.00					Latitude : 39.02 Longitude : -76.79				
Date: 2017-09-19			Universal Time: 15:38	Date: 2017-09-19		Universal Time: 15:50			Date: 2017-09-19		Universal_Time: 15:39		
	Opacity	Cloud Cover	Type		Altitude (km)	Opacity	Cloud Cover	Phase Temp(C)		Altitude (km)	Opacity	Cloud Cover	Phase Temp(K)
Total Ground Cloud Cover: Broken (50-90%)				Total GEO Cloud Cover: 56.82 %					Total Terra Cloud Cover: 69.12 %				
HIGH													
MID										4.98	Transparent 0.67	Clear (<10%) 0.12	ice 269.32 (K)
LOW	Opaque	Broken (50-90%)	Cumulus / Stratocumulus		0.85	Translucent 3.96	Broken (50%-90%) 56.82	water 20.33 (C)		0.94	Translucent 3.43	Broken (50%-90%) 69.01	mixed 288.87 (K)

Sky Visibility : no report
Sky Color : no report

Surface Conditions

Snow/Ice	No
Standing Water	No
Muddy	No
Dry Ground	Yes
Leaves on Trees	Yes
Raining or Snowing	No



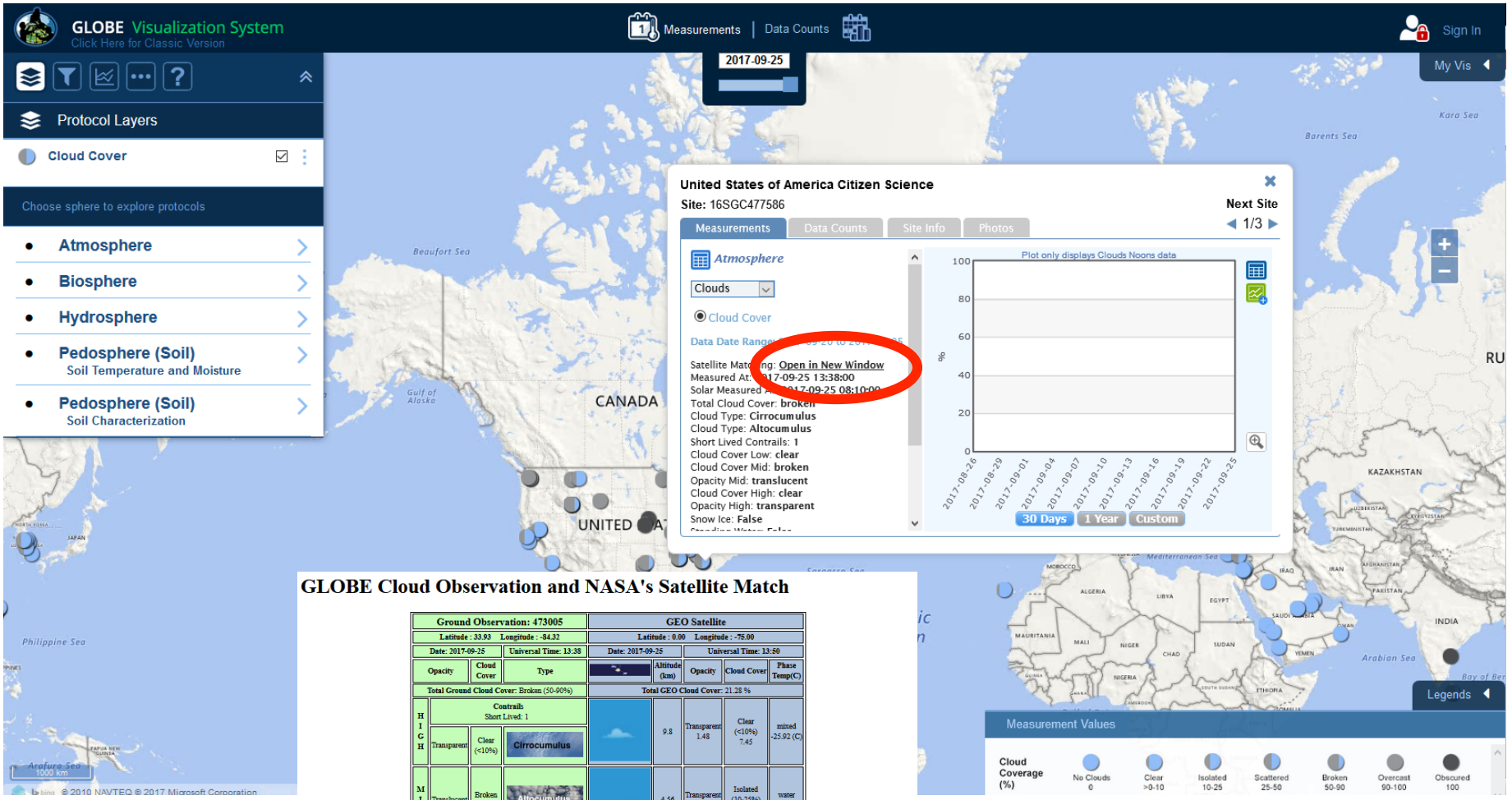
T(C)=Temperature(Celsius)

Corresponding Terra MODIS Satellite Images

Rapid Response

NASA Worldview

Observation Comment :



GLOBE Cloud Observation and NASA's Satellite Match

Ground Observation: 473005				GEO Satellite				
Latitude : 33.93 Longitude : -84.32				Latitude : 0.00 Longitude : -75.00				
Date: 2017-09-25		Universal Time: 13:38		Date: 2017-09-25		Universal Time: 13:50		
	Opacity	Cloud Cover	Type		Altitude (km)	Opacity	Cloud Cover	Phase Temp(C)
Total Ground Cloud Cover: Broken (50-90%)				Total GEO Cloud Cover: 21.28 %				
HIGH	Contrails Short Lived: 1							
	Transparent	Clear (<10%)	Cirrocumulus		9.8	Transparent 1.48	Clear (<10%) 7.45	mixed -25.92 (C)
MID	Translucent	Broken (50-90%)	Altocumulus		4.56	Transparent 1.93	Isolated (10-25%) 11.7	water -0.17 (C)
LOW	opacity not recorded	Clear (<10%)			1.66	Transparent 2.18	Clear (<10%) 2.13	water 14.24 (C)
Sky Visibility : no report Sky Color : no report								
Surface Conditions Snow/Ice No Standing Water No Muddy No Dry Ground Yes Leaves on Trees Yes Raining or Snowing No				T(C)=Temperature(Celsius)				
Observation Comment :								

ARTICLES

CERES S'COOL PROJECT UPDATE

The Evolution and Value of a Long-Running Education Project with a Foundation in NASA Earth Science Missions

LIN H. CHAMBERS, MEGAN A. MCKEOWN, SARAH A. MCCREA, ANN M. MARTIN, TINA M. ROGERSON, AND KRISTOPHER M. BEDKA

Since 1997, S'COOL has engaged interested participants worldwide in observing clouds and comparing data from ground and satellite sources to inform validation efforts for several NASA Earth science missions.

Scientists are increasingly interested in crowd-sourced data but have concerns about its accuracy. Begun nearly 20 years ago, the Students' Cloud Observations Online (S'COOL) project, introduced to *BAMS* readers in Chambers et al. (2003), offers a unique opportunity to inform this question. S'COOL arose from a confluence of education and science needs. Teachers are able to engage students in real-world science, while NASA obtains extensive ground-based data on clouds. Here we examine the record of participation and the information gathered to assess the value of crowd-sourced Earth system data and to illuminate important considerations for scientists considering involving a wider community in their work.

Imager-based cloud retrievals (cloud/no cloud and cloud properties such as phase, optical depth, and height) are some of the foundational data sources used to determine scene characteristics within each footprint of the Clouds and the Earth's Radiant Energy System (CERES; Wielicki et al. 1996) instrument. This information is needed to analyze the radiation balance throughout the day, a precursor to understanding the Earth radiation budget (ERB) at climatological time scales (Loeb et al. 2009). Thus, it is very important to understand the accuracy of cloud retrievals as biases can influence the CERES-derived ERB. Meanwhile, students in classrooms around the world learn about clouds and the scientific process as part of the school curriculum, and many adults observe the sky individually or through hobby clubs and organizations. S'COOL connects these interests by engaging students and others in cloud observations and analysis.

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The abstract for this article can be found in this issue, following the table of contents.
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because of the narrow lidar/radar instrument swaths, but when available provide the opportunity to evaluate cloud identification and layering reported from the ground. We developed display software in MATLAB that overlays the *CALIPSO*/*CloudSat* 2B-GEOPROF-lidar (herein CCGL) product (Mace and Zhang 2014) with the S'COOL observation information, providing the S'COOL team and potentially S'COOL observers themselves further insight into the strengths and weaknesses of their observations.

Figure 7 provides examples of these collocated data for two cases that exemplify some of the characteristics of S'COOL observations. For the case in Fig. 7a, the two datasets both agree on the presence of a single high cloud layer, confirming the accuracy of the S'COOL observation. On the other hand, Fig. 7b is a case where the S'COOL observer only observed a single low-level cloud layer, while the CCGL product shows that two higher cloud layers were present. The ground observer reported that the low-level cloud layer was opaque and overcast, indicating that it was too thick to see

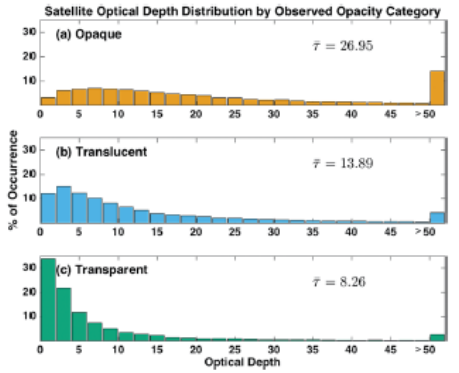


FIG. 6. The CERES MODIS optical depth retrieval distribution as a function of the three S'COOL observer cloud opacity categories: (a) opaque, (b) translucent, and (c) transparent. On average, observers are correctly classifying opacity: the mean optical depth ($\bar{\tau}$) decreases and the peak in percent occurrence shifts toward a lower optical depth value from (a) to (c). The peak at >50 optical depth for the transparent and translucent categories is an artifact of the matching process and does not reflect a deficiency in observer skill.

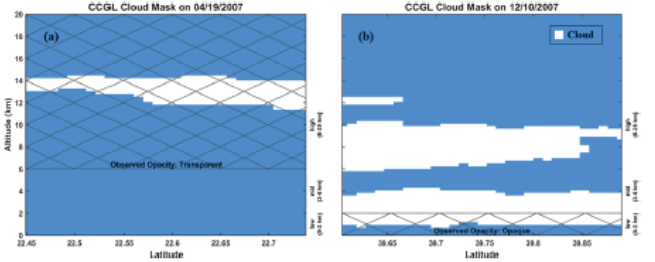
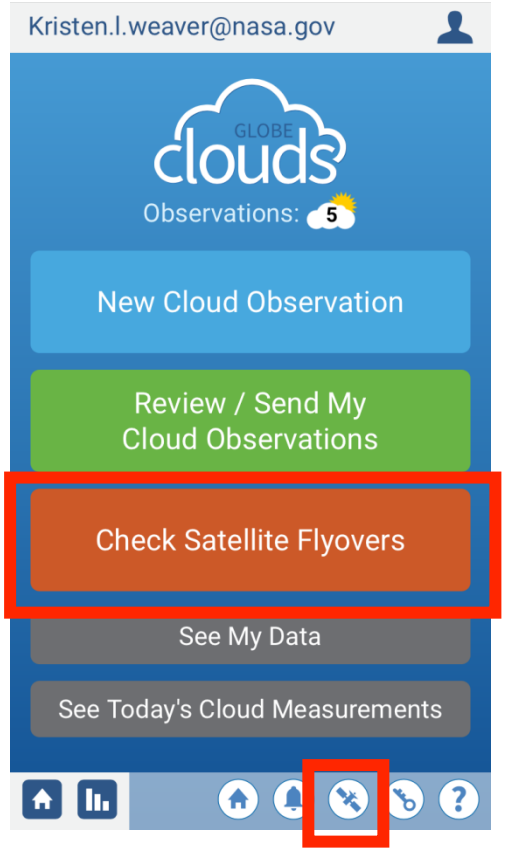
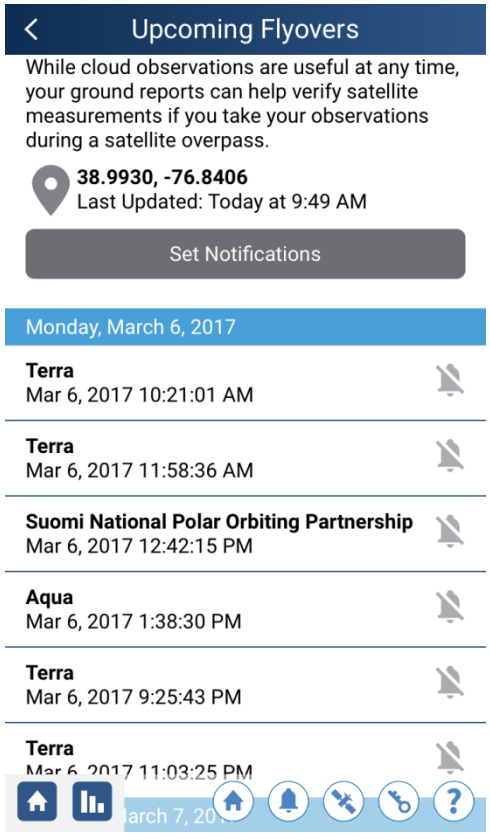


FIG. 7. CCGL cloud mask (blue = sky; white = cloud) overlaid with a collocated S'COOL observation. The hatched overlay indicates the cloud height category reported by the S'COOL observer. (a) A case where the S'COOL observer accurately reported a single high cloud layer. (b) A case where the S'COOL observers were unable to see the CCGL-detected cloud layers above the low-level cloud they reported due to the high opacity and overcast coverage of the low-level cloud. Similarly, a passive satellite instrument would see only the top layer.

http://journals.ametsoc.org/doi/full/10.1175/BAMS-D-15-00248.1

- GLOBE Observer app identifies overpass times based on your lat/lon
- Allows you to set alarms for overpass times





Cloud Observation Metrics

Total Observations for 2017	80,587
GEO Satellite Matches	51,046
CERES Satellite Matches	10,036
CALIPSO Satellite Matches	36
Total Combined Satellite Matches for 2017	**61,118**

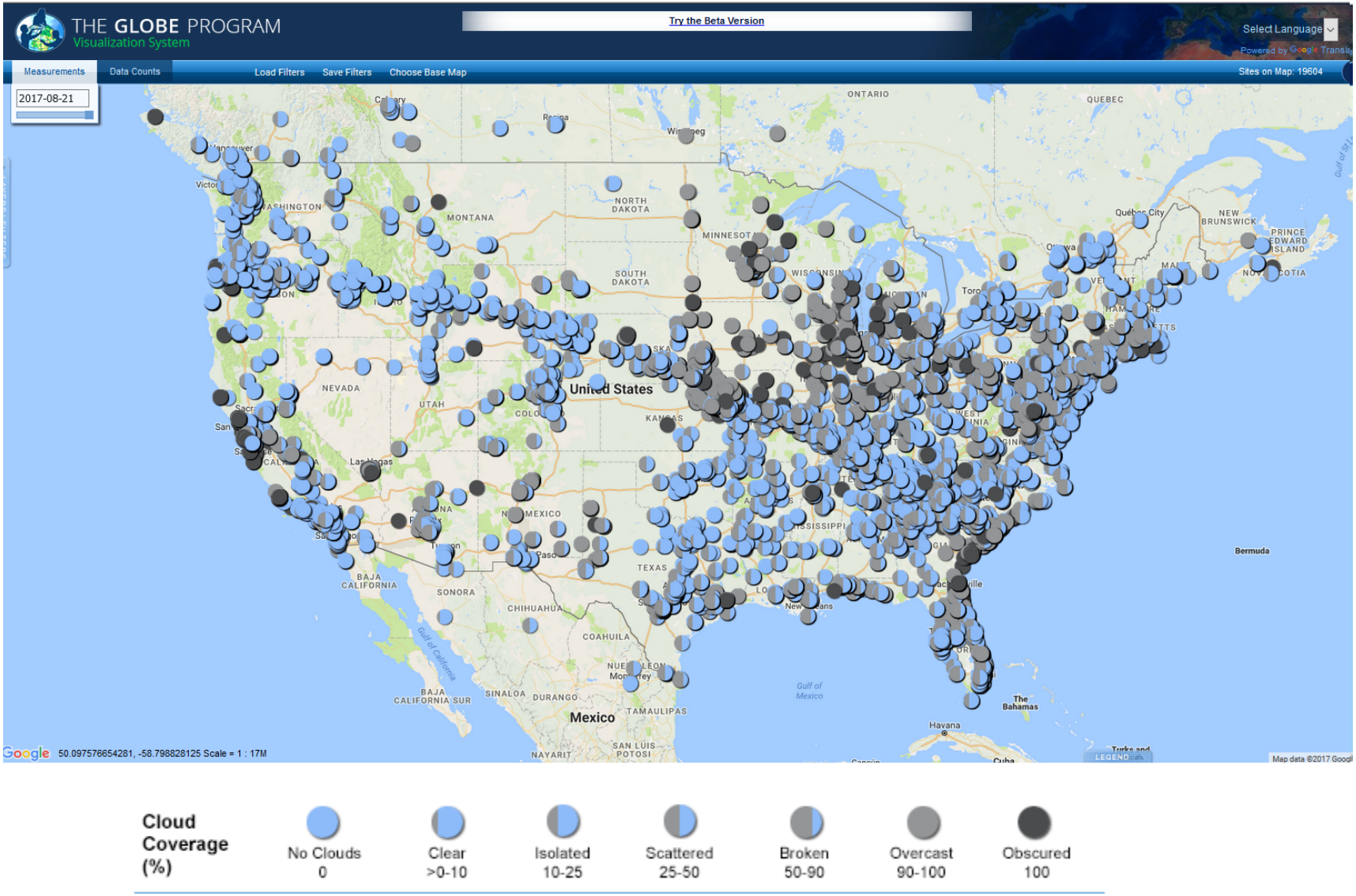
* Metrics from Jan 1, 2017 – Sept 10, 2017

Eclipse Connections

- GLOBE Community submitted air temperature and cloud observations before, during, and after the eclipse

- Over 18,000 cloud observations made August 21st using GLOBE Observer

Clouds During the Eclipse



Over 18,000 clouds observations with more than 61,000 clouds photos submitted on 8/21

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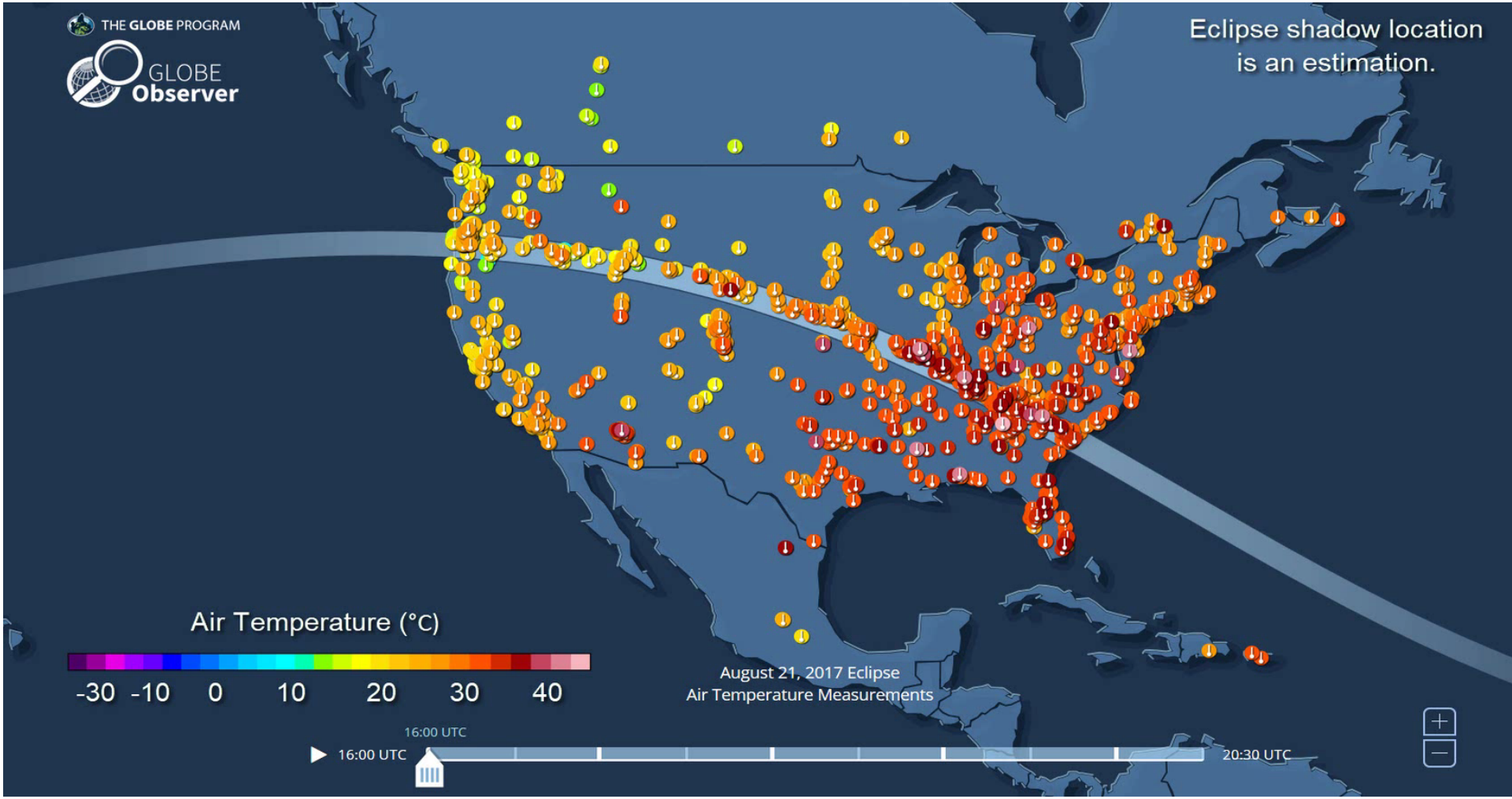
Contact me: kristen.l.weaver@nasa.gov

Air Temperature



Over 76,000 air temperature measurements reported